System-Wide Assessment and Monitoring Program (SWAMP)

Barataria Pilot - Progress

Richard Raynie
Coastal Protection and Restoration Authority

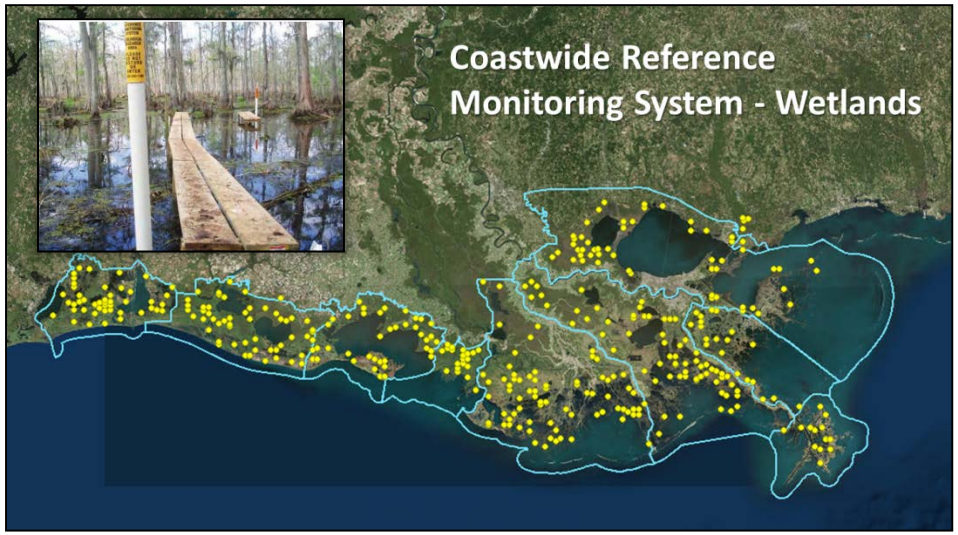
4 August 2015

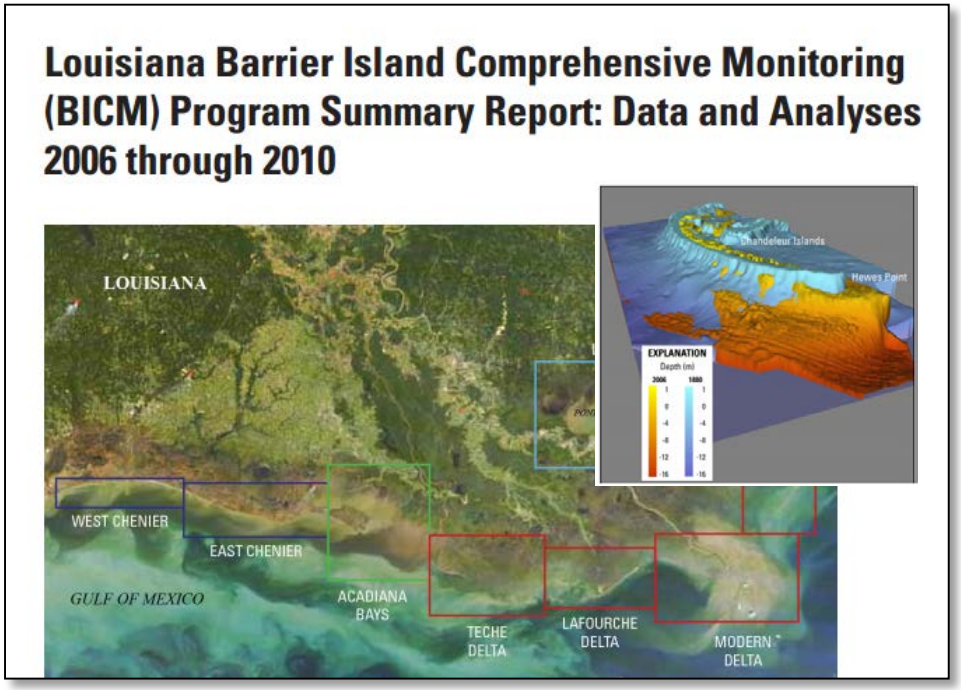
CPRA
Coastal Protection and Restoration Authority of Louisiana

committed to **our coast**

Where We Started

- Coastwide Reference Monitoring System (CRMS) (*2005-present*)
- Barrier Island Comprehensive Monitoring Program (BICM) (*2006-present*)
- Other agencies & entities…





DEQ LOUISIANA

USGS science for a changing world

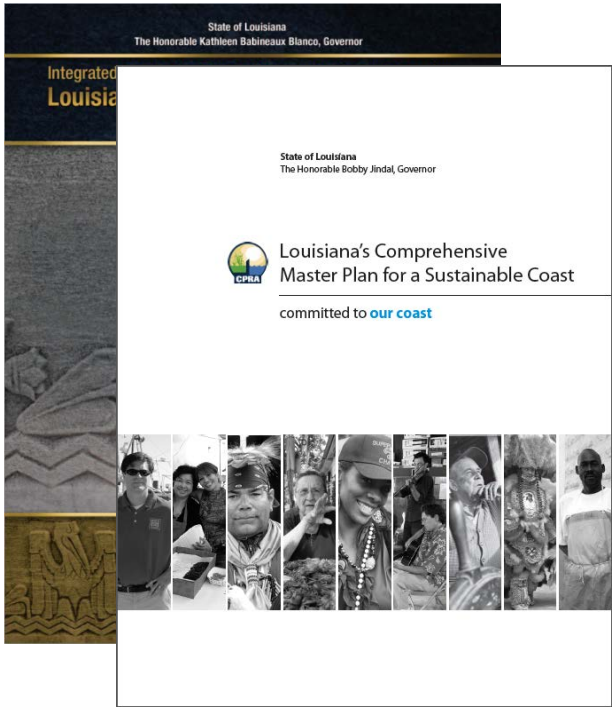
THE LOUISIANA DEPARTMENT OF WILDLIFE AND FISHERIES

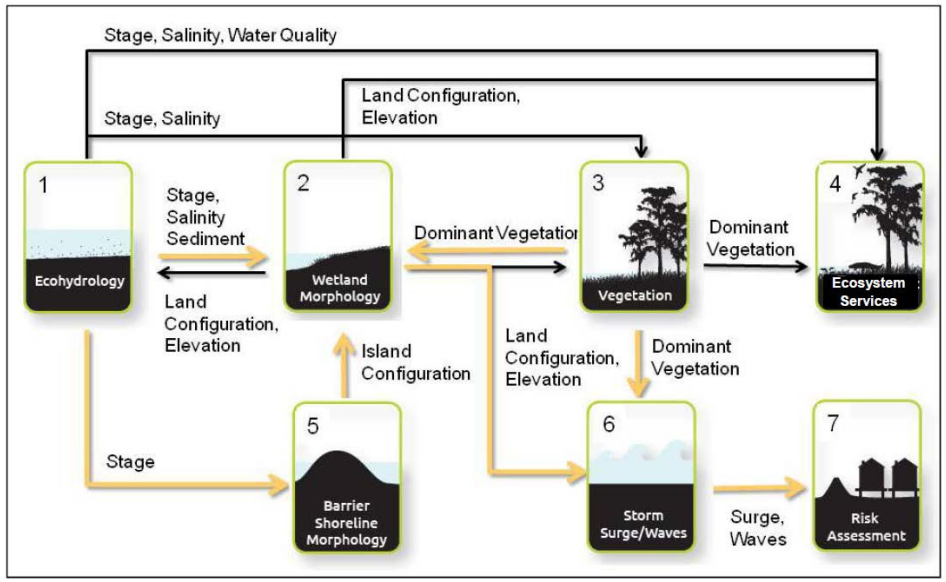
United States™ Census Bureau

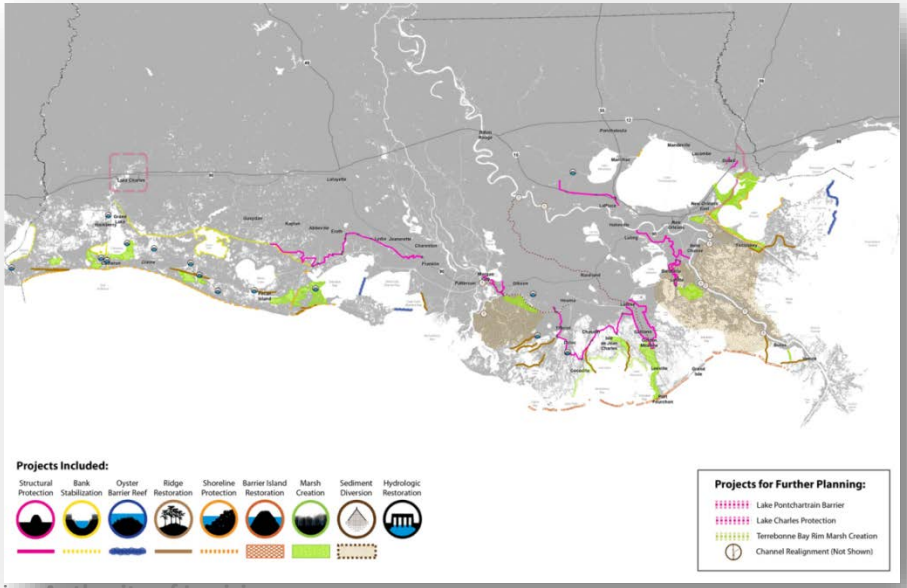
National Oceanic and Atmospheric Administration's
National Data Buoy Center
Center of Excellence in Marine Technology

Changing Data Needs

- Support Master Plan tools
- Resolve Uncertainties
- Actively and adaptively manage projects and programs
- Evaluate effectiveness of projects and collective effects
- Evaluate socio-economics
- Evaluate risk reduction







System-Wide Assessment and Monitoring Program (SWAMP)

- Vision is for integrated protection and restoration monitoring (*cutting edge and robust*)

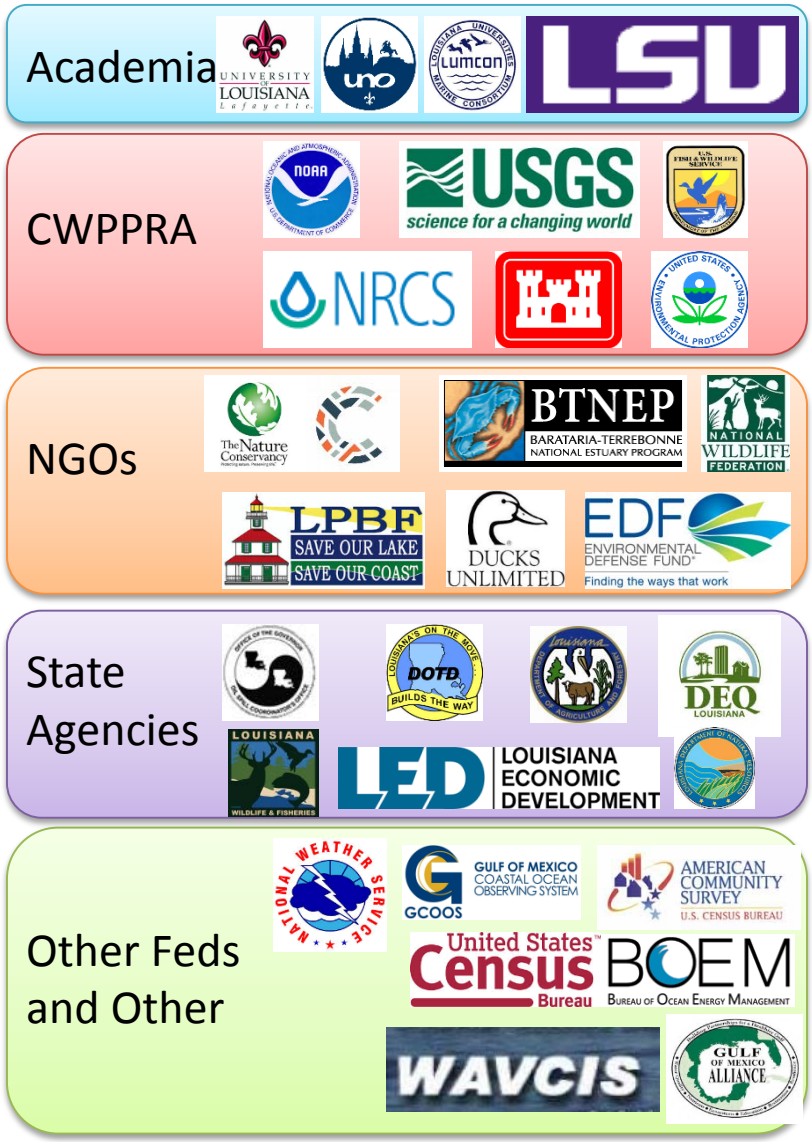
- Data network will support Master Plan models and other tools, project models, program performance metrics (*measure success/change in human and natural systems*)

- Include opportunities for leveraging and partnership among a variety of agencies (*building on existing monitoring programs*)

SWAMP Acknowledgements

- The Water Institute of the Gulf, Leads
  - Ann Hijuelos – Natural System
  - Scott Hemmerling – Human System

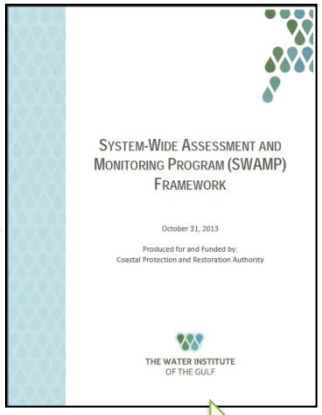
- SWAMP Team Members
  - **CPRA**: Karim Belhadjali, Bill Boshart, Rickey Brouillette, Honora Buras, Angelina Freeman, Mandy Green, Bren Haase, Ed Haywood, Syed Khalil, Jennifer Mouton, James Pahl, Carol Parsons Richards, Melanie Saucier, Leigh Anne Sharp, John Troutman, Chuck Villarrubia, Billy Wall, Dona Weifenbach
  - **The Water Institute of the Gulf**: Mead Allison, Tim Carruthers, Katelyn Costanza, Ehab Meselhe, Leland Moss, Joao Pereira, Denise Reed, Dallon Weathers, and Brendan Yuill
  - **External SMEs**: Mark Hester (ULL), Bryan Piazza (TNC), Erick Swenson (LSU), Troy Blanchard (LSU), Rex Caffey (LSU), Mary Christman (MCC Statistical)



SWAMP Development

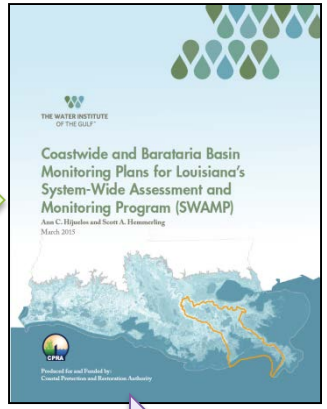
Planning 2013

- Framework
- Data Inventory
- Performance Measures



Design 2014/15

- Power Analysis
- Sample Size Determination
- Statistical Design
- Coastwide and Barataria Basin



Implementation 2015/16

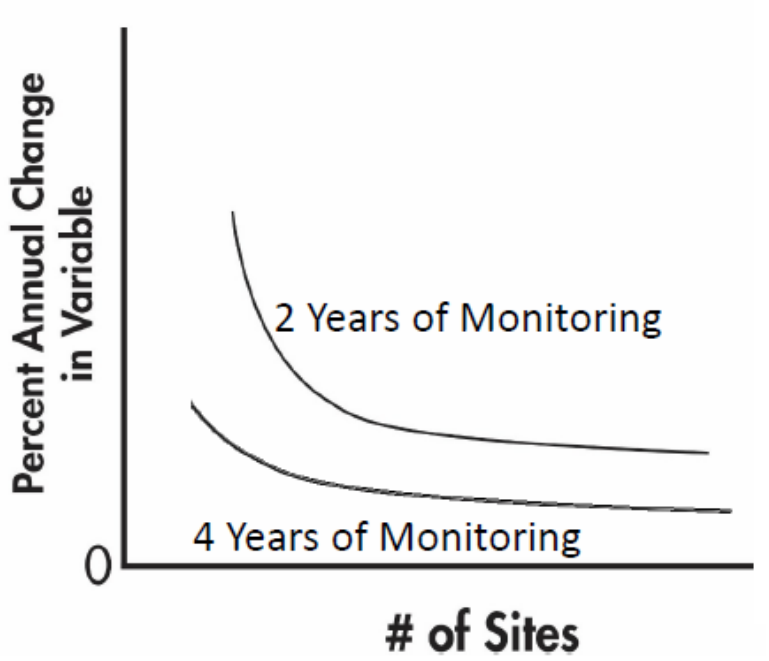
- Linking/Leveraging with Existing Programs
- Developing/Refining Data Standards, SOPs, QA/QC, Data Management

SWAMP Natural System
Barataria Pilot

- Biotic Integrity
  - Nekton community composition
  - Oyster biomass
  - Soil condition
  - Wetland vegetation biomass
  - Vegetative community composition
- Water Quality
  - Chlorophyll *a*
  - Dissolved Oxygen
  - Nutrient constituents (N, P, Silica)
  - Salinity
  - Turbidity
  - Suspended sediment concentration
- Weather and Climate
  - Potential Evapotranspiration
  - Precipitation
  - Wind
- Hydrology
  - Current velocity
  - Water level
  - Waves
- Physical Terrain
  - Surface elevation
  - Bathymetry
  - Land area

SWAMP Development

- Design:
  - Power Analysis
    - *statistical power to detect real change*
  - Sample Size Determination
    - *how many stations do we need to be representative*



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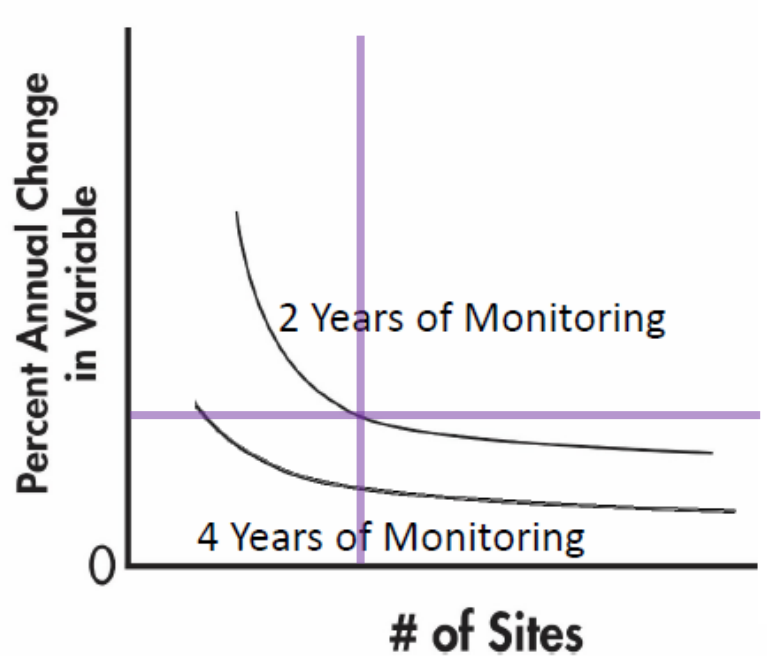

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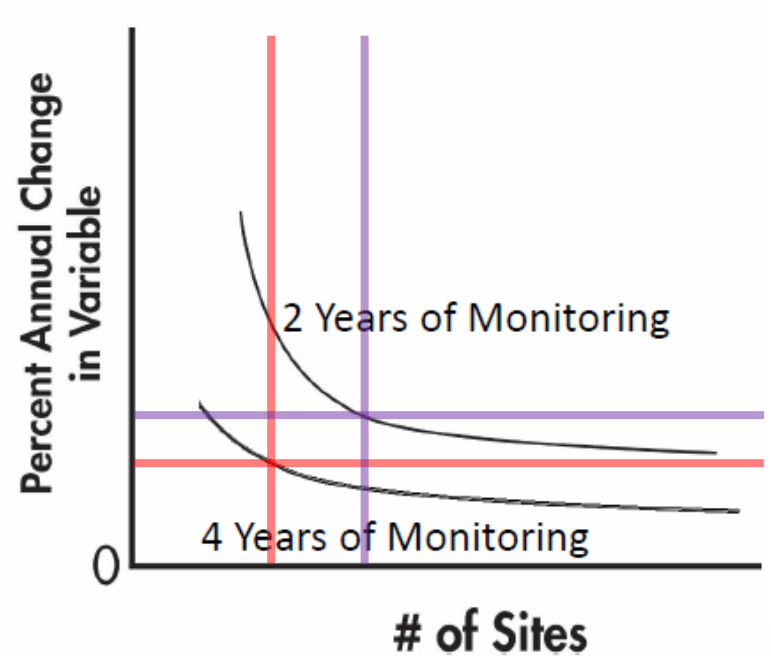


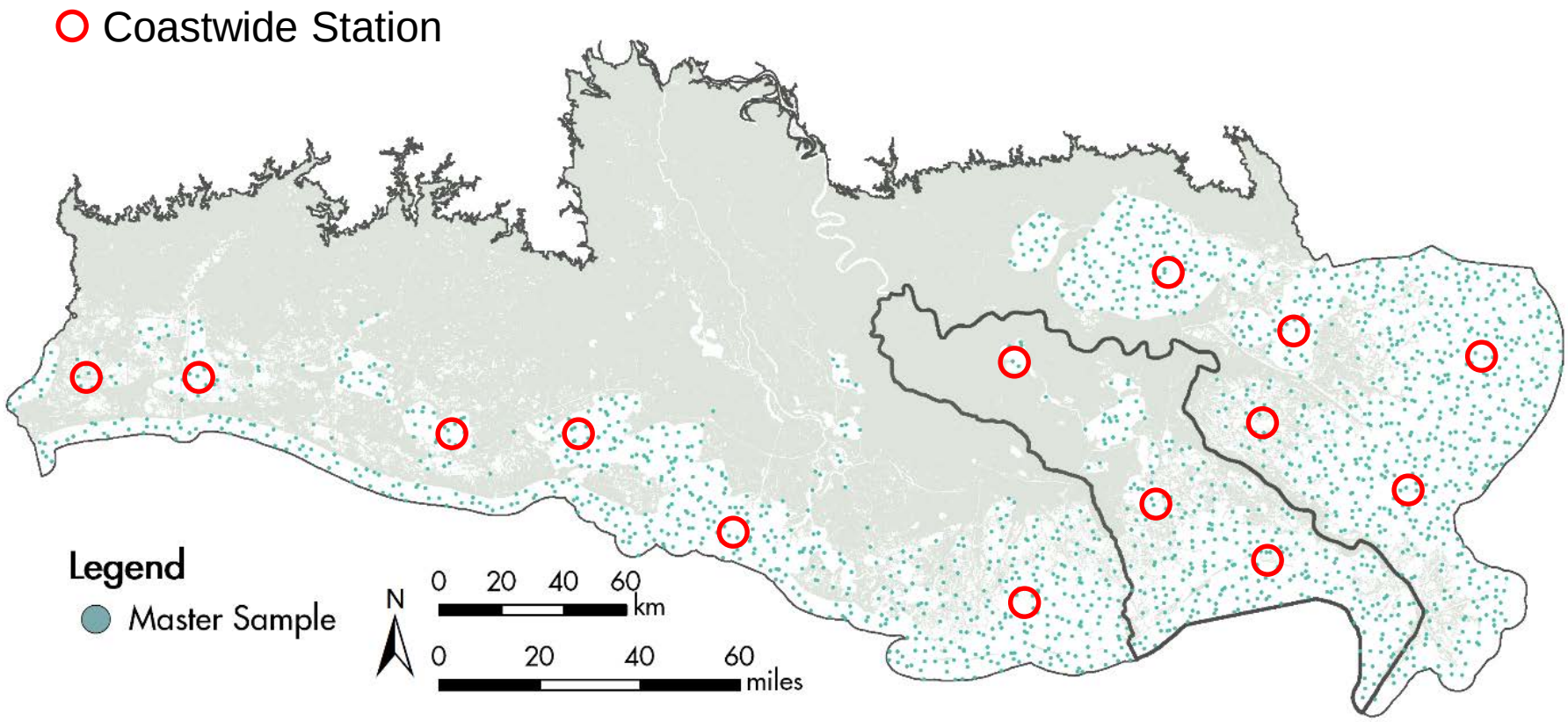
SWAMP Development

- Design:
  - Power Analysis
    - *statistical power to detect real change*
  - Sample Size Determination
    - *how many stations do we need to be representative*
  - Statistical Design
    - *where do the stations need to be located*

SWAMP Design

Coastwide and Barataria Example - Natural System

Generalized Random Tessellation Stratified (GRTS) Design



SWAMP Design

Coastwide and Barataria Example - Natural System

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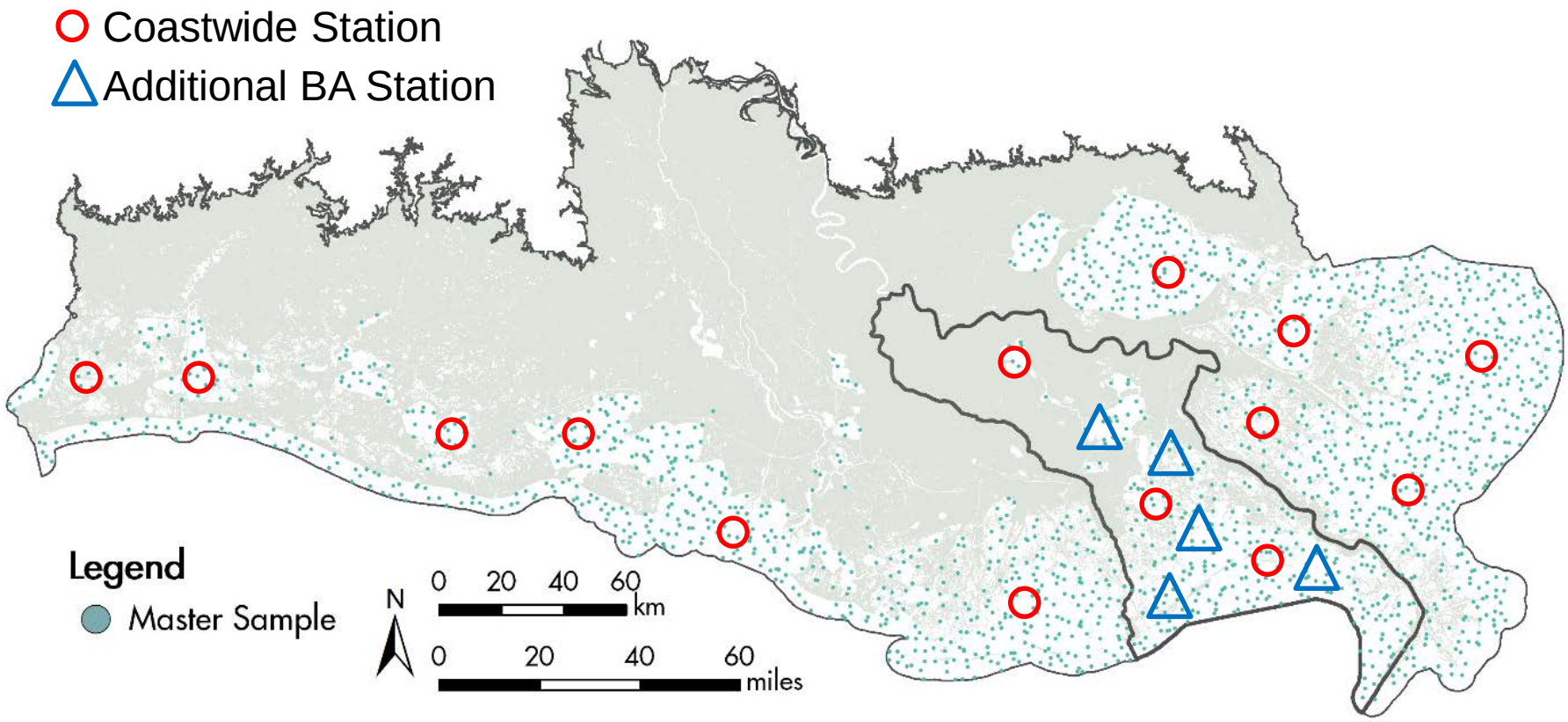
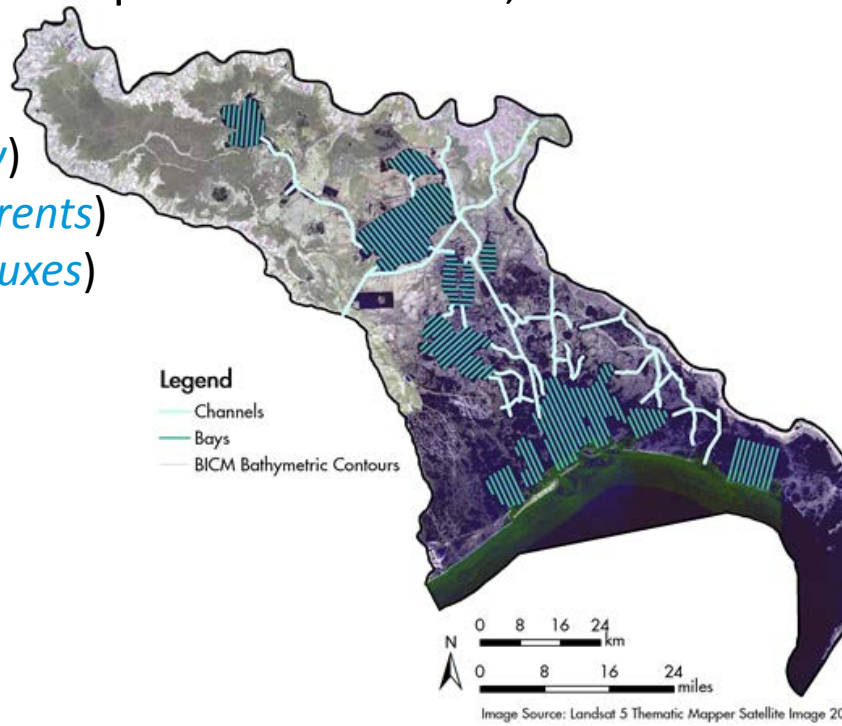


SWAMP Design

Coastwide and Barataria Example - Natural System

- Also used **expert knowledge** to address data needs to support planning models by providing data that can be used for parameterizations, calibration, and validation
- General modeling needs were identified:
  - spatial coverage (*e.g., inshore bathymetry*)
  - boundary conditions (*e.g., waves and currents*)
  - system exchange points (*e.g., tidal pass fluxes*)



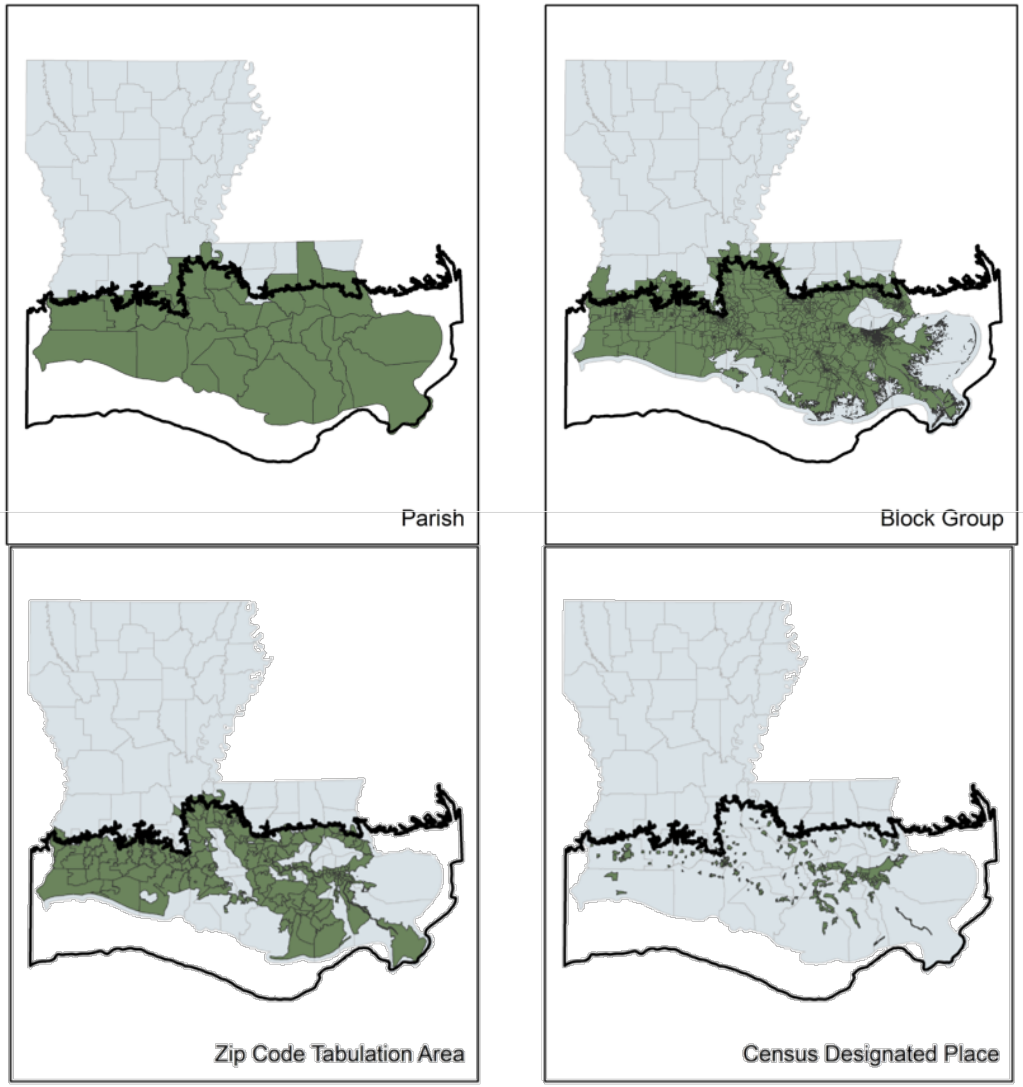
These were applicable to:

- Weather and Climate:
  - precipitation, wind, evapotranspiration
- Hydrology:
  - current velocity, water level, waves
- Physical Terrain:
  - bathymetry, land area, surface elevation

SWAMP Design

Coastwide and Barataria Example – Human System

- Four different geopolitical units of analysis: parishes, census block groups, ZIP code areas, and census designated places



SWAMP Design

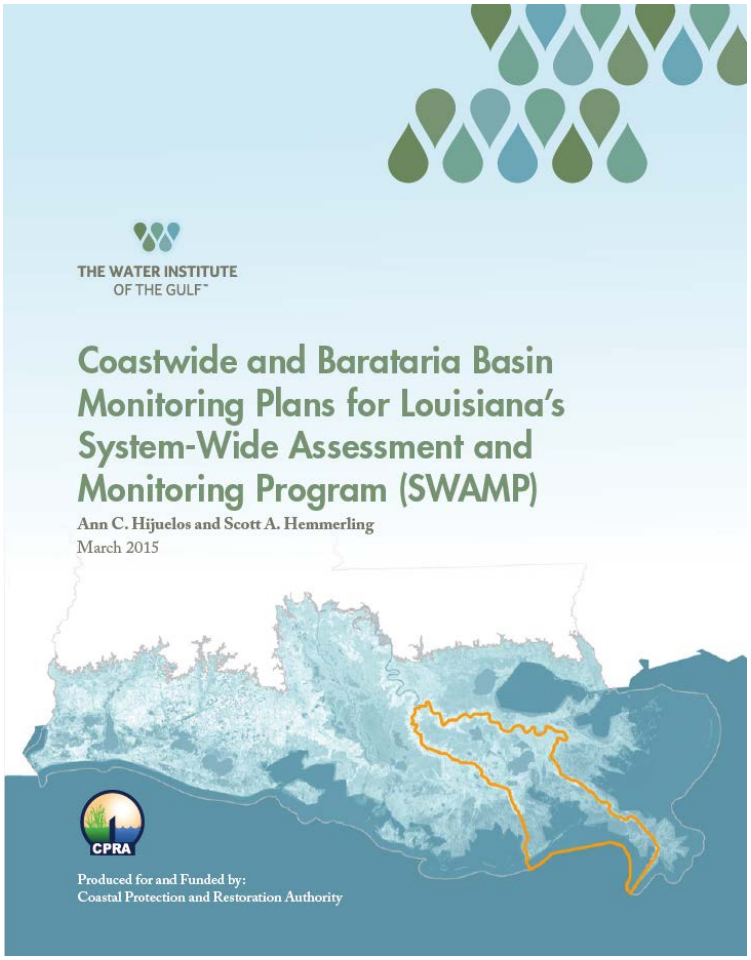
Coastwide and Barataria Example – Human System

- Census and ACS data can be aggregated to **delineate functional community areas**

  - Geographic Communities
    - *population centers*
  - Occupational Communities
    - *areas dependent upon natural resources such as agriculture and fisheries*
  - Physical Risk and Vulnerable Communities
    - *potential exposure to coastal inundation and flood risk; areas receiving structural protection or non-structural protection*
  - Natural Resource Extraction Sites
    - generated using *trip ticket data to monitor catches within coastal basins; agricultural yield data to look at changes in productivity within coastal basins*

SWAMP Development

- Design:
  - SWAMP Monitoring Plans
    - *Coastwide and BA Pilot*
    - *Design Completed in March 2015*



SWAMP Implementation

- Refinement and Implementation:
  - Coordinating/Linking/Leveraging with Existing Programs

Natural (June 8, 2015-ongoing dialogs)	Human (scheduled for mid-August)
USGS – LA Water Science Center	Louisiana SeaGrant
USGS – National Wetlands Research Center	USACE
USGS – Coastal and Marine Science Center	Gov. Office of Homeland Security and Emergency Preparedness
NOAA	Office of Community Development
National Data Buoy Center	NOAA Gulf Coast Services Center & National Centers for Coastal Ocean Science
Louisiana Dept. Environmental Quality	Barataria-Terrebonne National Estuary Program
Louisiana Dept. Wildlife and Fisheries	

  - Initiate new activities to fill identified data gaps

Natural	Human
• Fisheries (LDWF) • Bathymetry (private contractor) • Water Quality (in development) • Above and below ground biomass (in development)	• Dialog among socioeconomic monitoring programs, discuss needs for socioeconomic data, and also look for opportunities to leverage resources among programs • Future development of tools to fill socioeconomic data gaps

  - Coordinate with project teams to coordinate nested project-scale monitoring plans within Barataria Basin
  - Developing/Refining Data Standards, SOPs, QA/QC, Data Management
  - Coordinate with Coastal Information Management System (CIMS) team to add new data types to CPRA's website

SWAMP Natural System
Barataria Pilot

- Biotic Integrity
  - Nekton community composition
  - Oyster biomass
  - Soil condition
  - Wetland vegetation biomass
  - Vegetative community composition
- Water Quality
  - Chlorophyll *a*
  - Dissolved Oxygen
  - Nutrient constituents (N, P, Silica)
  - Salinity
  - Turbidity
  - Suspended sediment concentration
- Weather and Climate
  - Potential Evapotranspiration
  - Precipitation
  - Wind
- Hydrology
  - Current velocity
  - Water level
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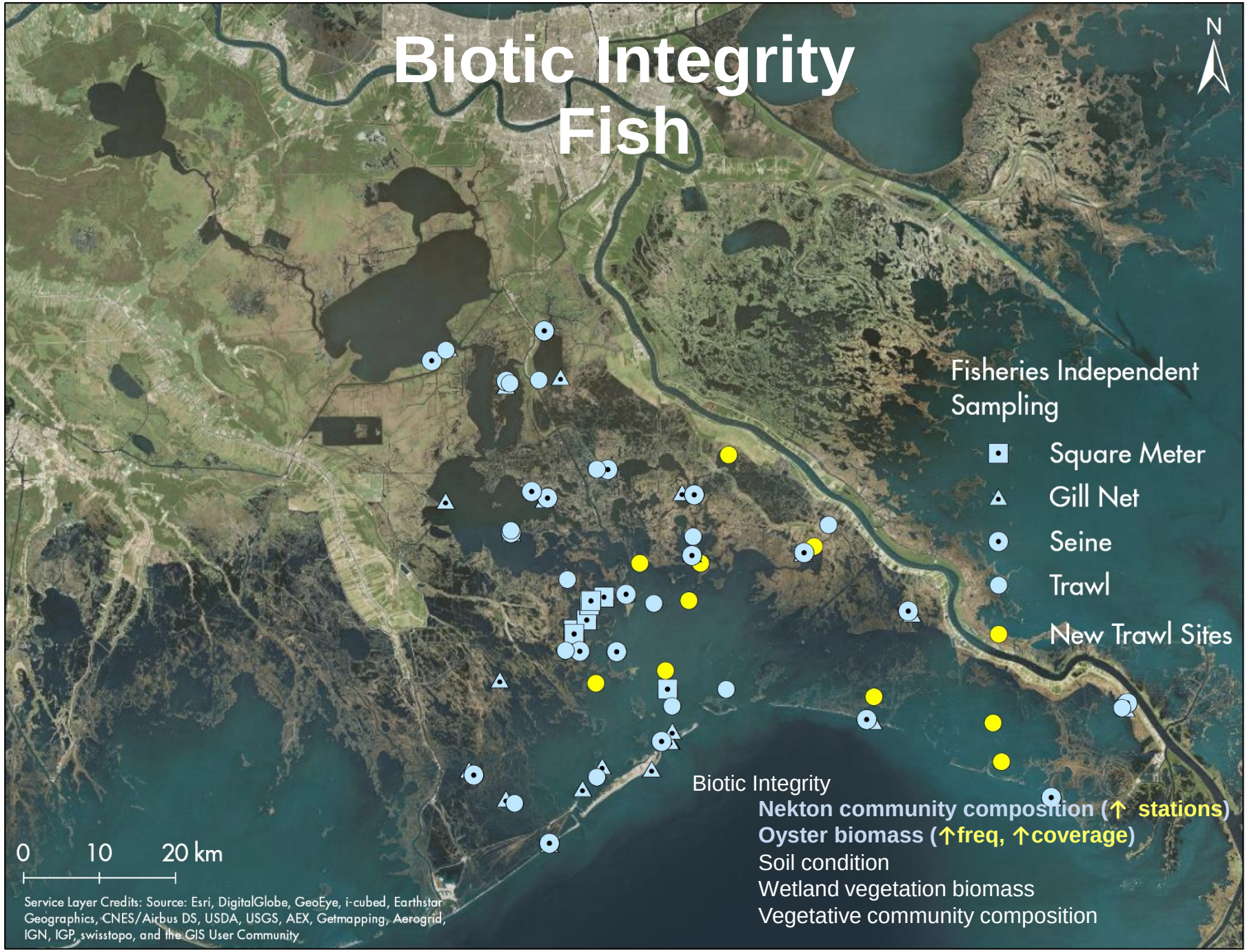
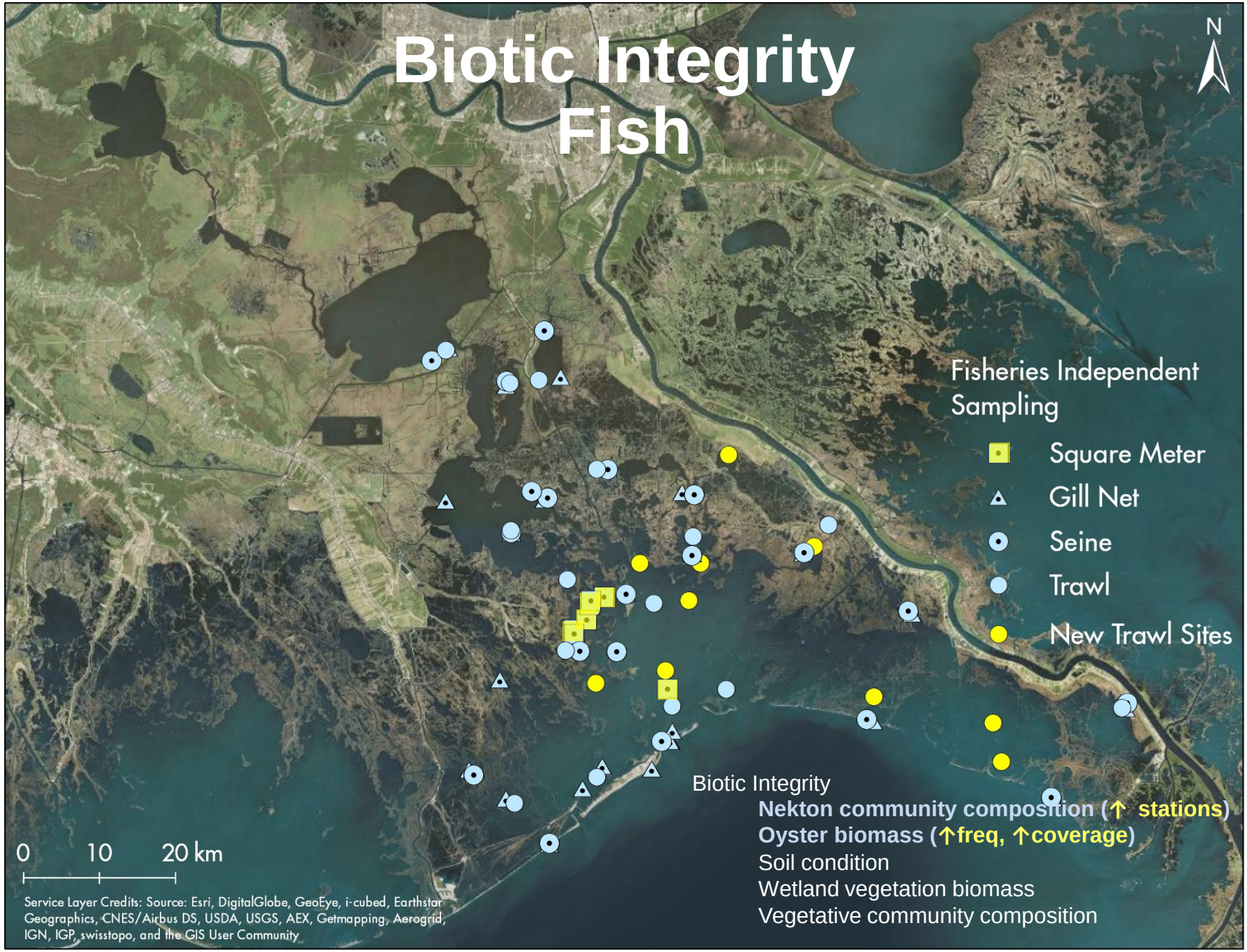

Biotic Integrity
Fish
N
Fisheries Independent Sampling
Square Meter
Gill Net
Seine
Trawl
New Trawl Sites
Biotic Integrity
Nekton community composition (↑ stations)
Oyster biomass (↑freq, ↑coverage)
Soil condition
Wetland vegetation biomass
Vegetative community composition
0
10
20 km
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community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0 10 20 km
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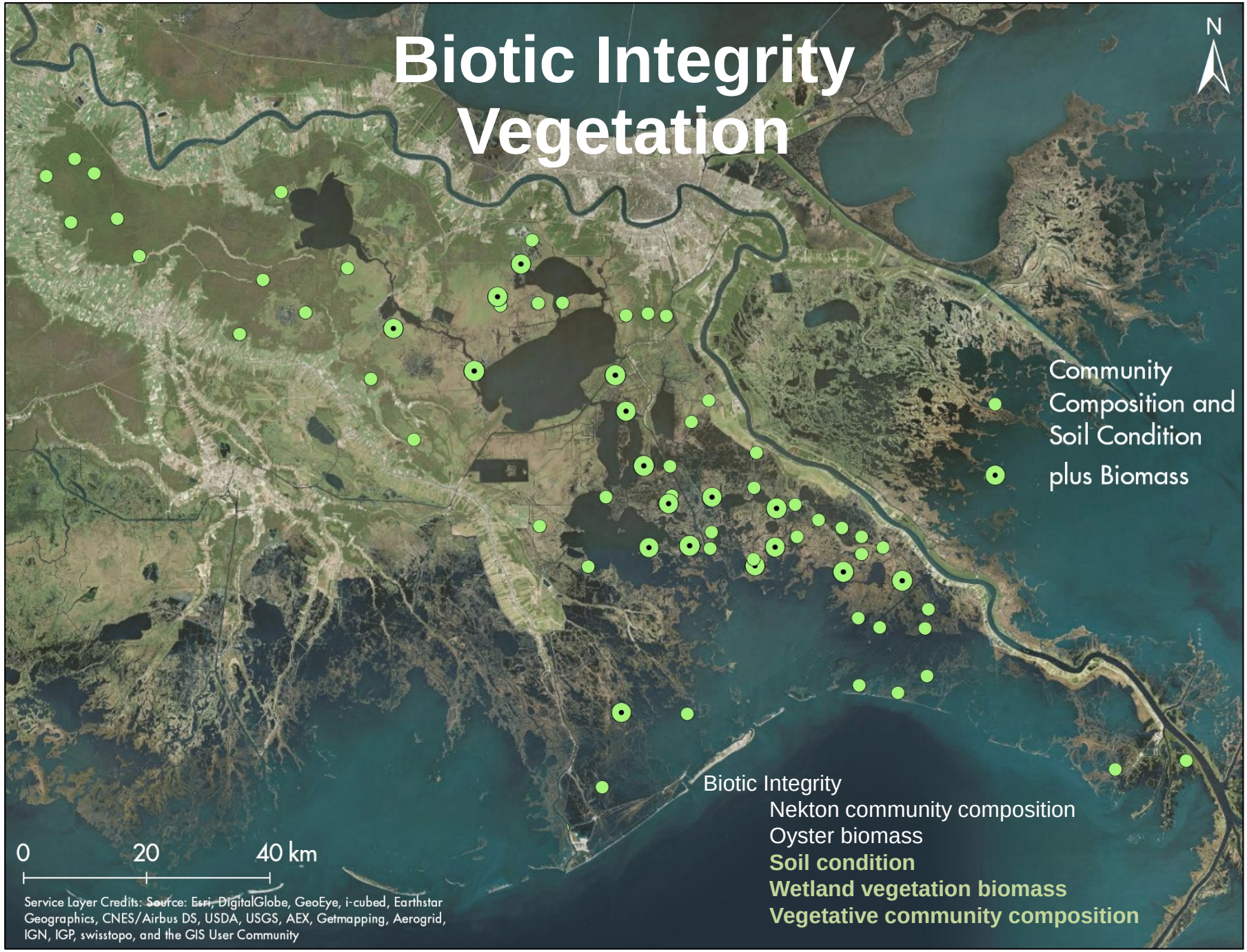
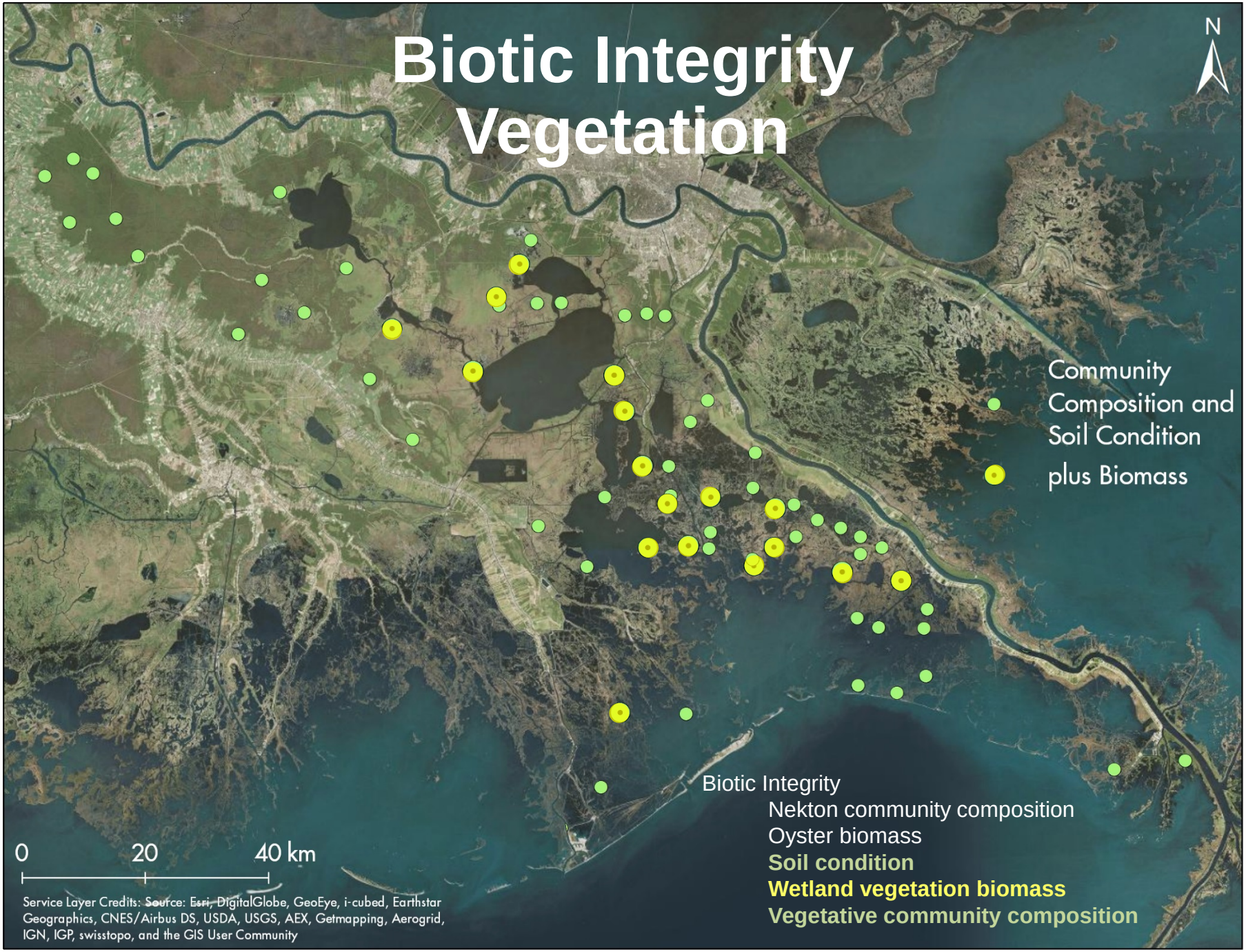

Biotic Integrity
Vegetation
N
Community
Composition and
Soil Condition
plus Biomass
Biotic Integrity
Nekton community composition
Oyster biomass
Soil condition
Wetland vegetation biomass
Vegetative community composition
0
20
40 km
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community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SWAMP Natural System
Barataria Pilot

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  - Chlorophyll *a*
  - Dissolved Oxygen
  - Nutrient constituents (N, P, Silica)
  - Salinity
  - Turbidity
  - Suspended sediment concentration
- Weather and Climate
  - Potential Evapotranspiration
  - Precipitation
  - Wind
- Hydrology
  - Current velocity
  - Water level
  - Waves
- Physical Terrain
  - Surface elevation
  - Bathymetry
  - Land area


Continuous
Water Quality
Water Quality
Chlorophyll a
Dissolved Oxygen
Nutrient constituents (N, P, Silica)
Salinity
Turbidity
Suspended sediment concentration


Continuous
Water Quality
N
Water Quality
USGS (Sal, Temp, Water Level)
Water Quality
Chlorophyll *a*
Dissolved Oxygen
Nutrient constituents (N, P, Silica)
Salinity
Turbidity
Suspended sediment concentration
0 10 20 km
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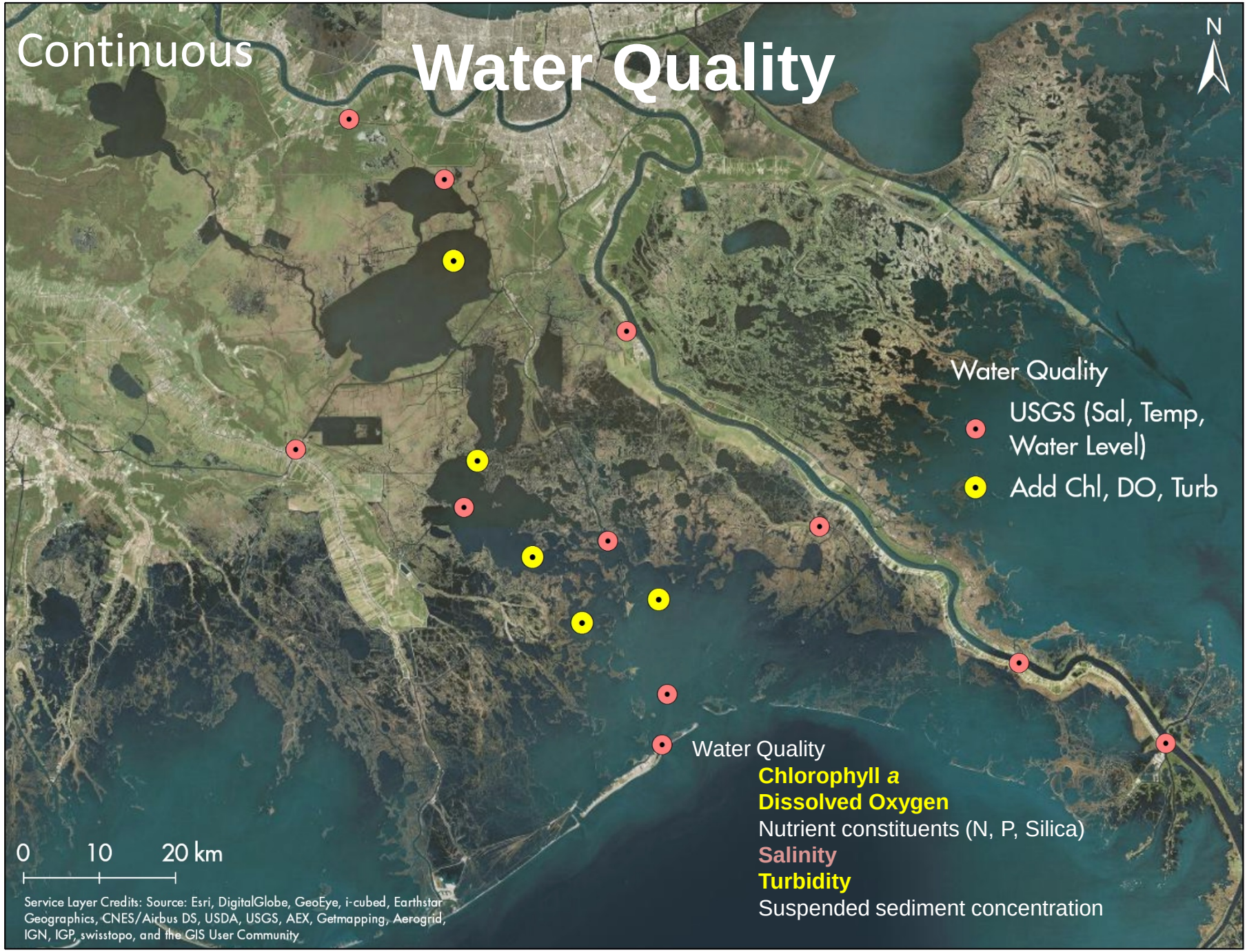
Continuous
Water Quality
N
Water Quality
USGS (Sal, Temp, Water Level)
Add Chl, DO, Turb
Water Quality
Chlorophyll a
Dissolved Oxygen
Nutrient constituents (N, P, Silica)
Salinity
Turbidity
Suspended sediment concentration
0 10 20 km
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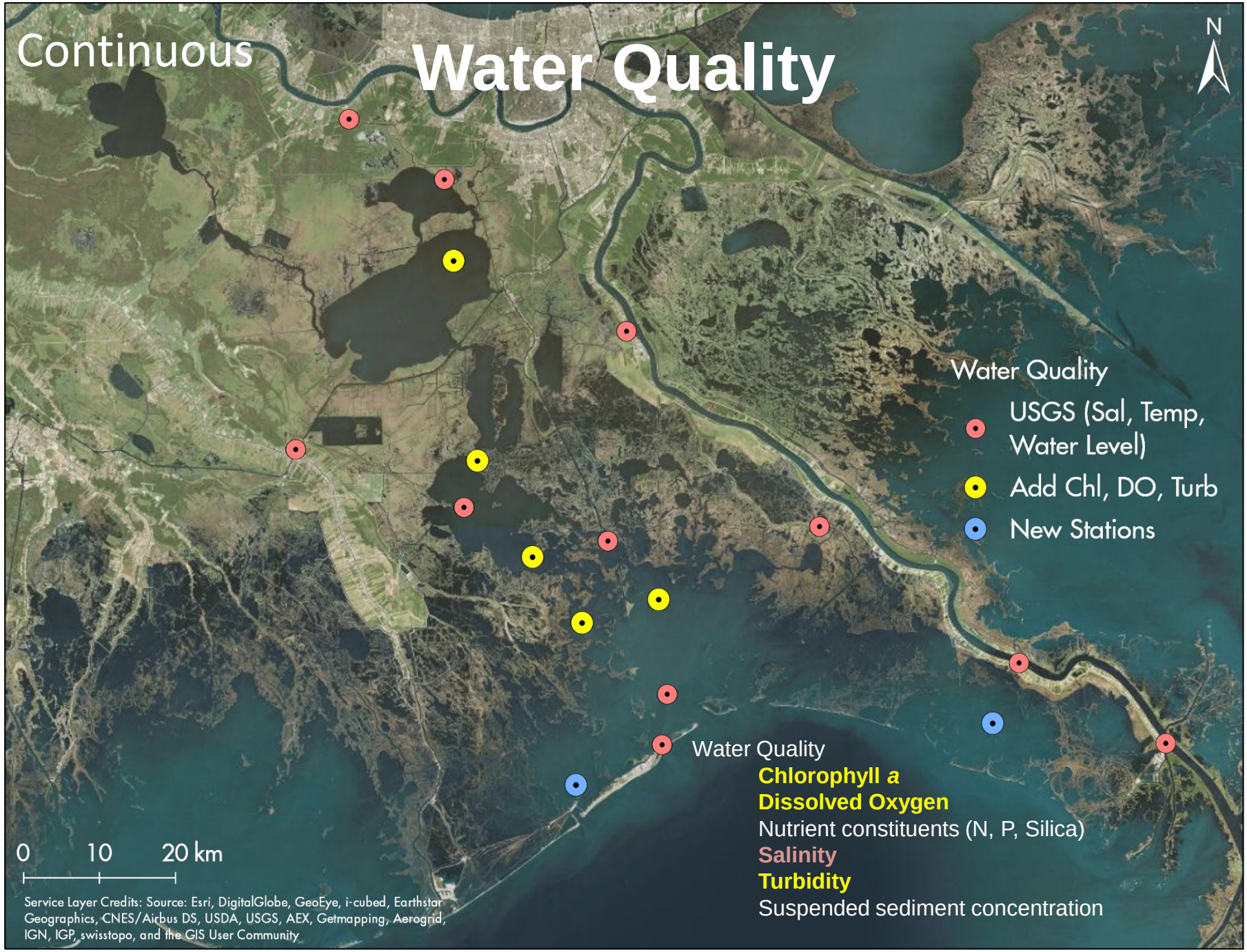
Continuous
Water Quality
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Water Quality
USGS (Sal, Temp, Water Level)
Add Chl, DO, Turb
New Stations
Water Quality
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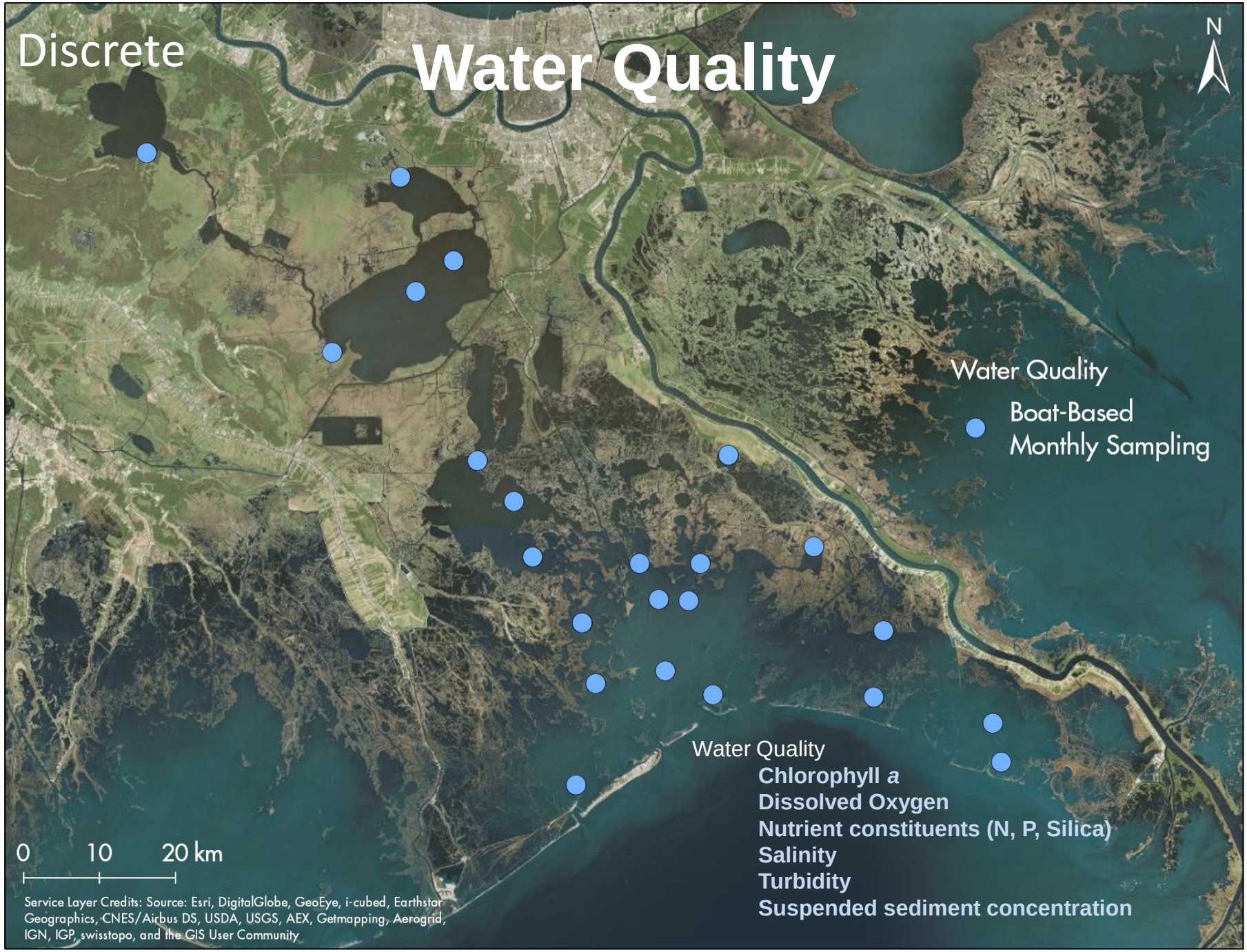
Discrete
Water Quality
N
Water Quality
Boat-Based
Monthly Sampling
Water Quality
Chlorophyll a
Dissolved Oxygen
Nutrient constituents (N, P, Silica)
Salinity
Turbidity
Suspended sediment concentration
0 10 20 km
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Water Quality

Water Quality
- USGS (Sal, Temp, Water Level)
- Add Chl, DO, Turb
- New Stations
- Boat-Based Monthly Stations (plus TSS, TN,TP)

Water Quality
- Chlorophyll *a*
- Dissolved Oxygen
- Nutrient constituents (N, P, Silica)
- Salinity
- Turbidity
- Suspended sediment concentration

0 10 20 km

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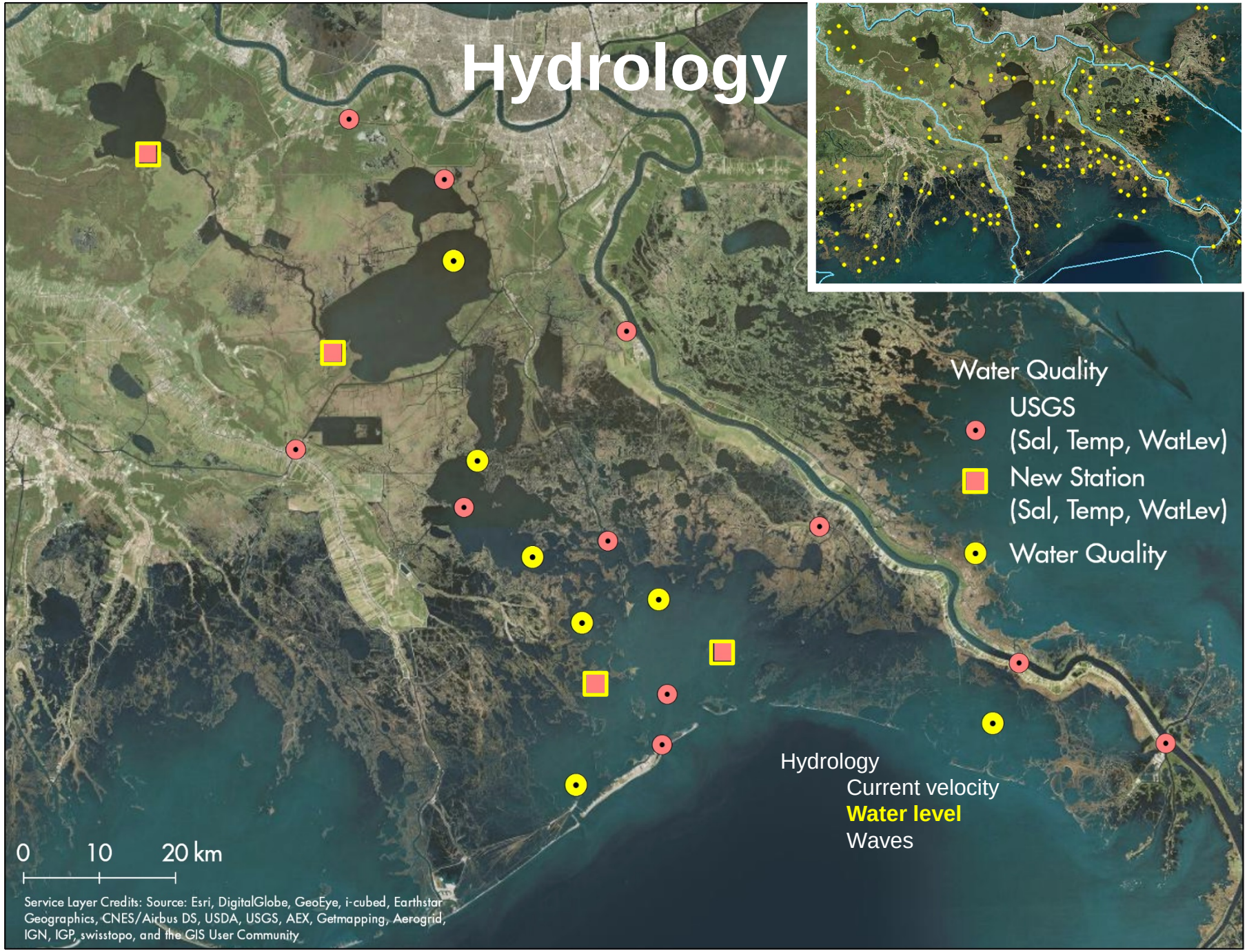
Hydrology
Water Quality
USGS
(Sal, Temp, WatLev)
New Station
(Sal, Temp, WatLev)
Water Quality
Hydrology
Current velocity
Water level
Waves
0
10
20 km
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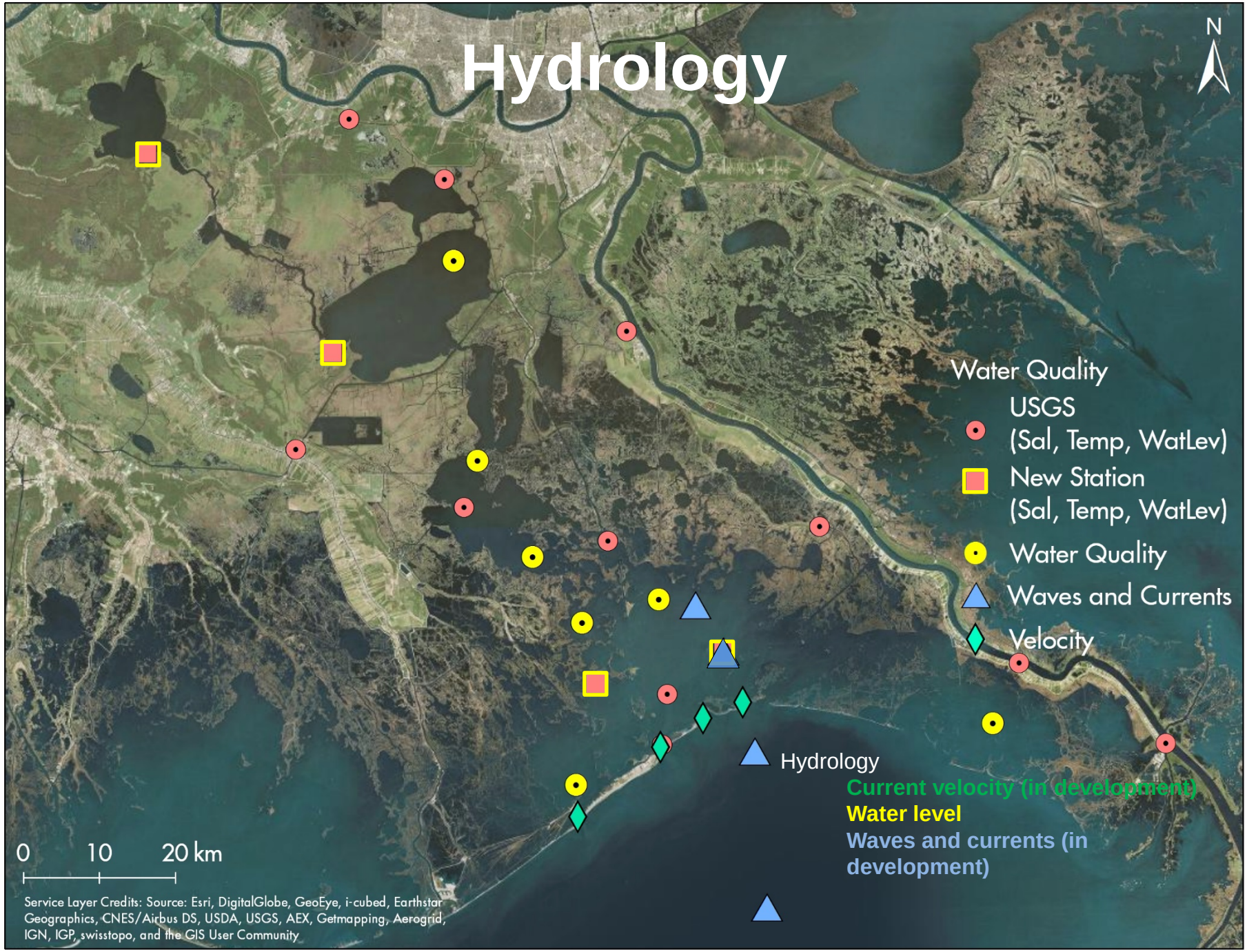
Hydrology
N
Water Quality
USGS
(Sal, Temp, WatLev)
New Station
(Sal, Temp, WatLev)
Water Quality
Waves and Currents
Velocity
Hydrology
Current velocity (in development)
Water level
Waves and currents (in development)
0
10
20 km
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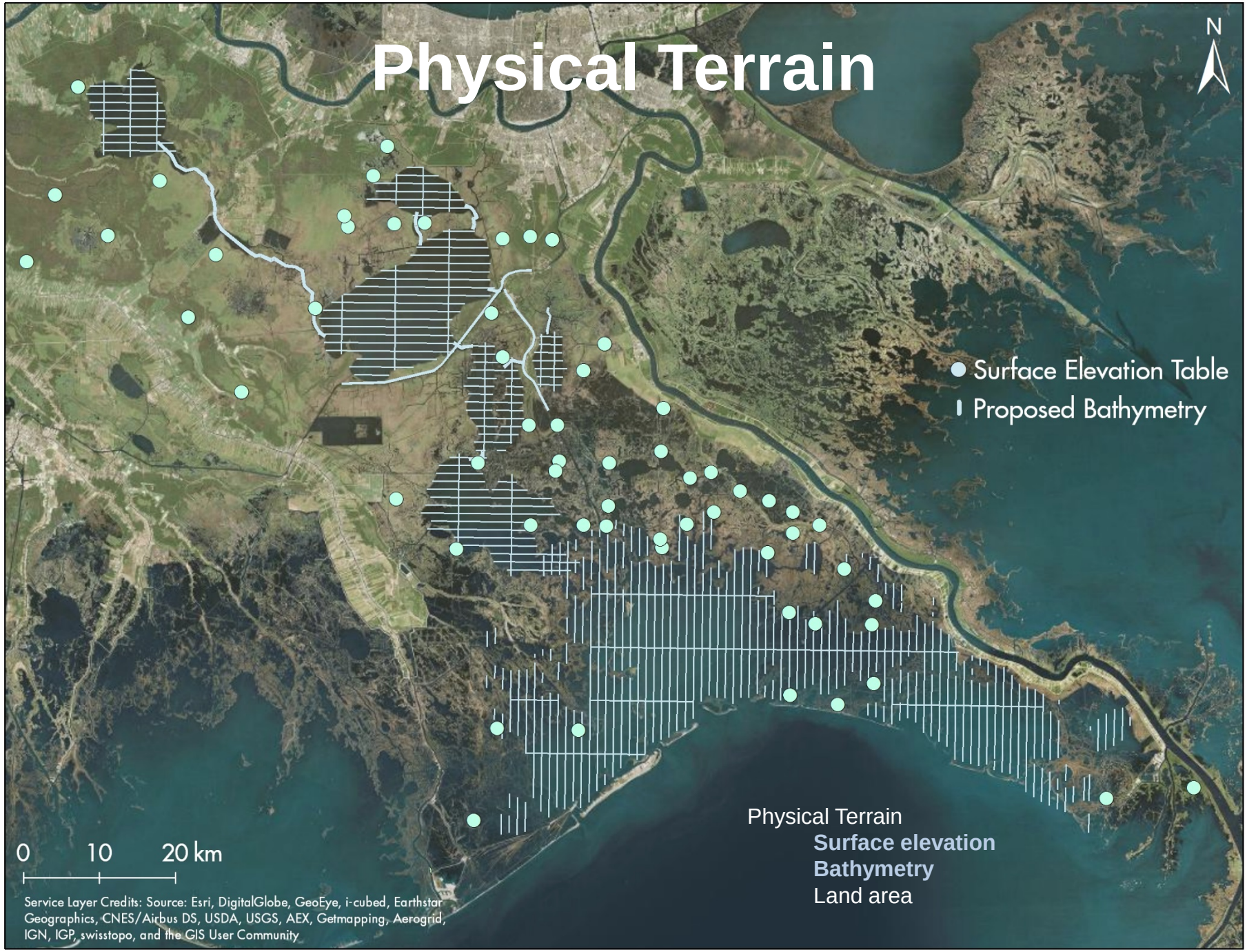
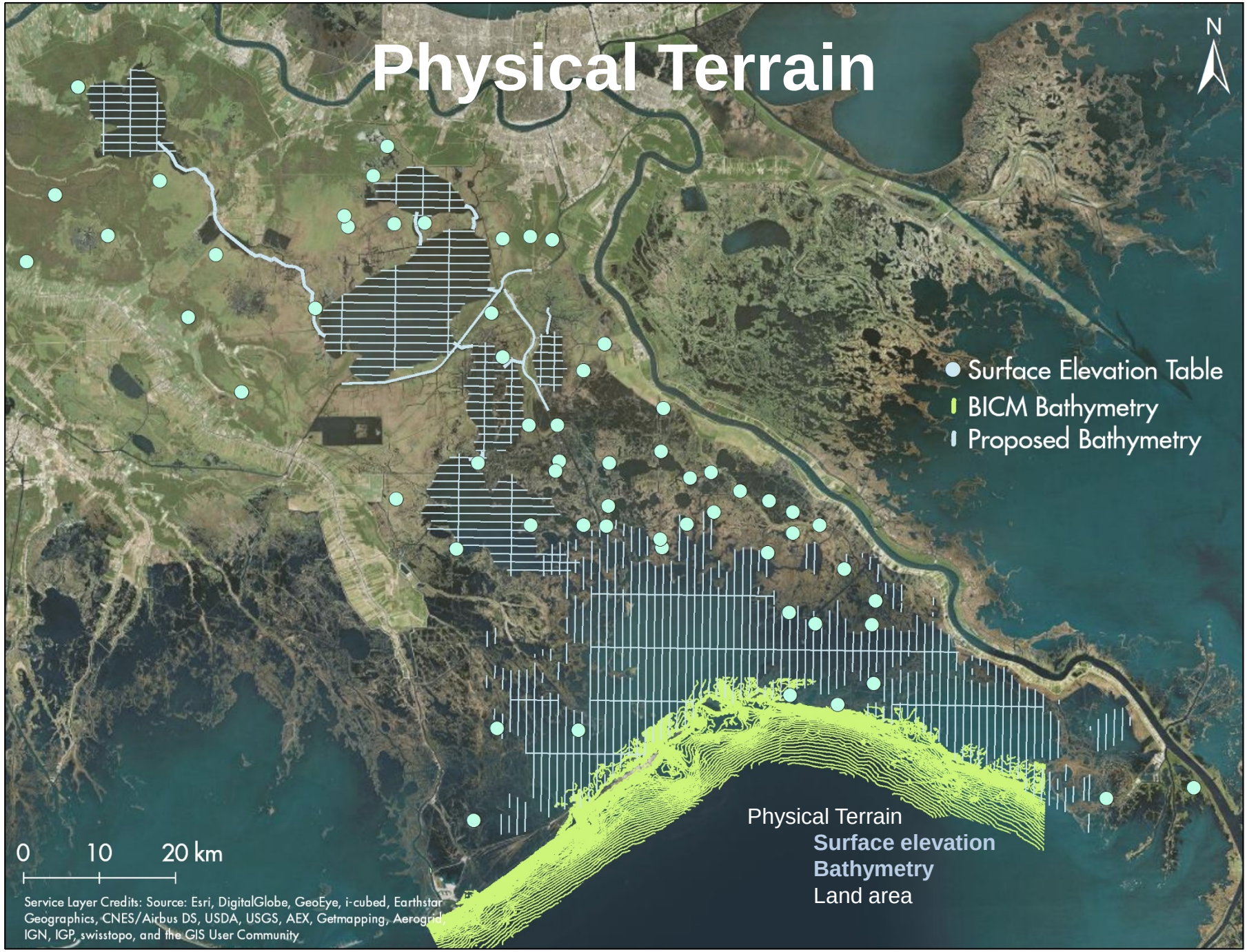
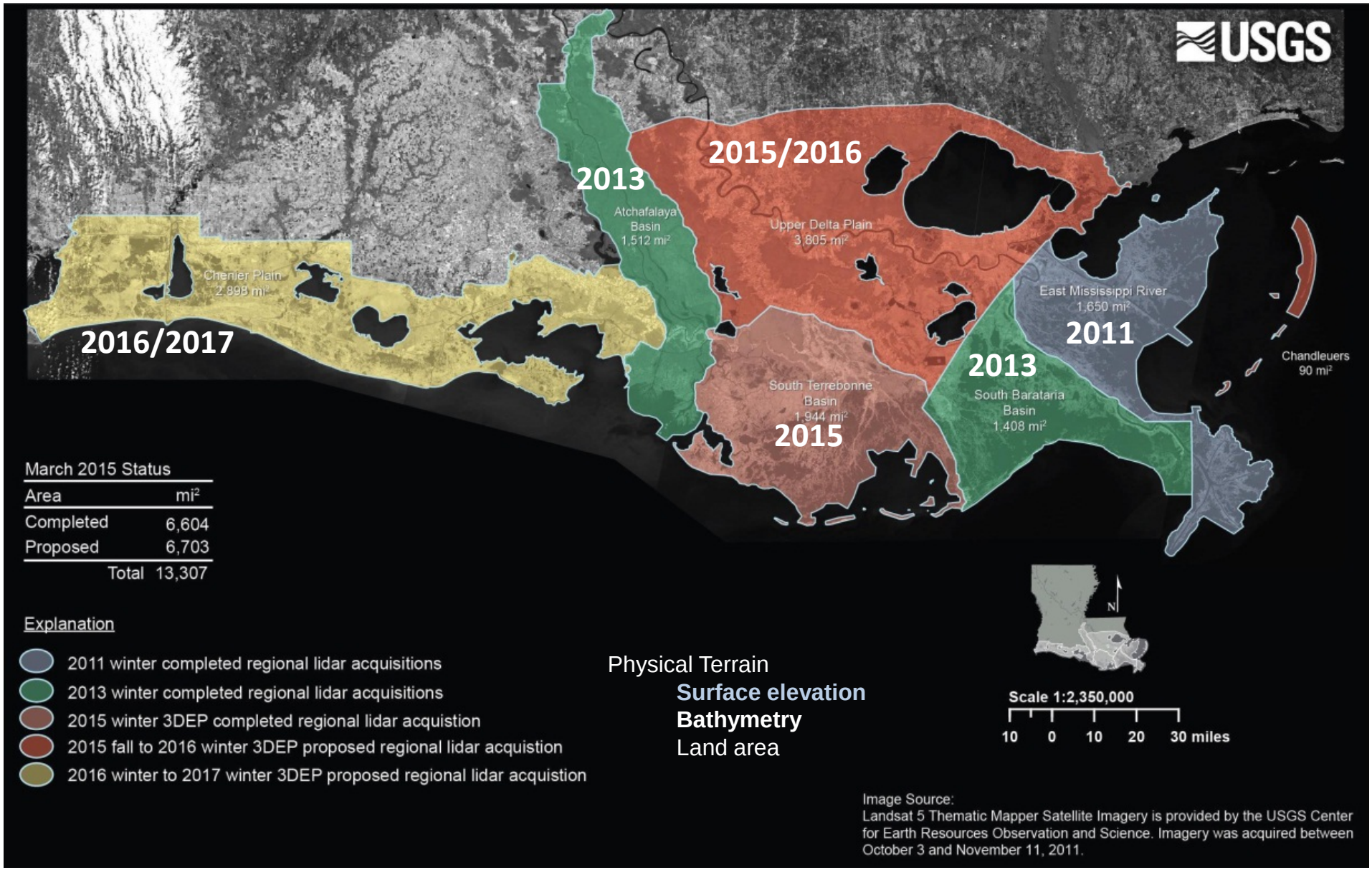

Physical Terrain
N
Surface Elevation Table
Proposed Bathymetry
0
10
20 km
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
Physical Terrain
Surface elevation
Bathymetry
Land area


Physical Terrain
N
Surface Elevation Table
BICM Bathymetry
Proposed Bathymetry
Physical Terrain
Surface elevation
Bathymetry
Land area
0
10
20 km
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

SWAMP Physical Terrain



Human System Variables

- Population and Demographics
  - # of households
  - Race and ethnicity
  - Total population
- Housing and Community Characteristics
  - Residential stability
  - Home ownership
  - Residential occupancy rates
  - Property values
- Economy and Employment
  - Economic development
  - Income levels
  - Poverty rates
  - Unemployment levels
- Ecosystem Dependency
  - Tourism and recreational use of natural resources
  - Natural resource extraction
  - Natural resource-based employment
  - Cultural and traditional use of natural resources
- Protection of Residential Properties
  - Assess residential risk reduction
  - Households receiving structural protection
  - Residential properties receiving nonstructural protection
- Protection of Critical Infrastructure and Essential Services
  - Assess risk reduction for critical facilities
  - Miles of levees created and maintained
  - Number of critical facilities protected by levees
  - Public and commercial properties receiving nonstructural protection

SWAMP Implementation

- Refinement and Implementation:
  - Coordinating/Linking/Leveraging with Existing Programs

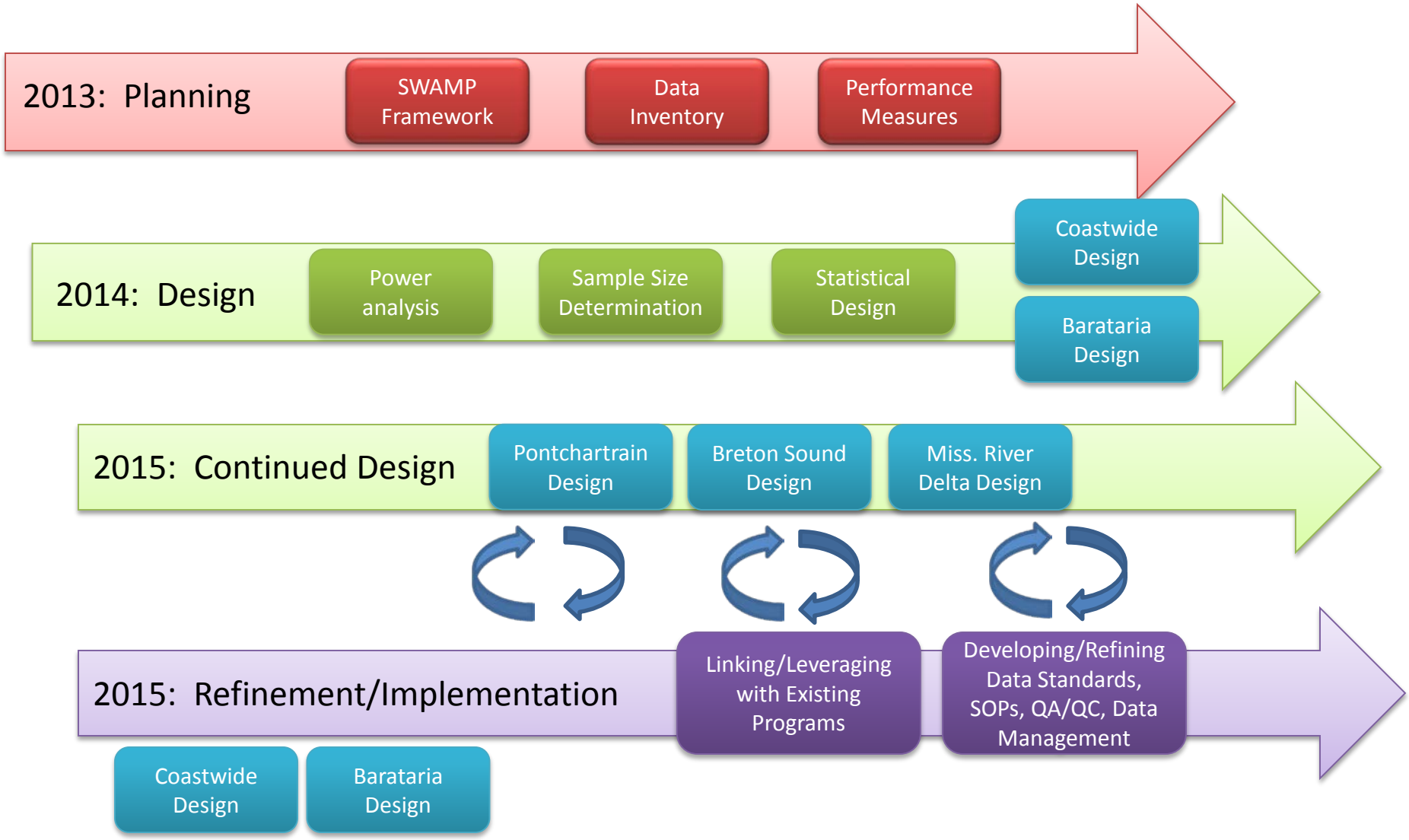
Natural (June 8, 2015-ongoing dialogs)	Human (scheduled for mid-August)
USGS – LA Water Science Center	Louisiana SeaGrant
USGS – National Wetlands Research Center	USACE
USGS – Coastal and Marine Science Center	Gov. Office of Homeland Security and Emergency Preparedness
NOAA	Office of Community Development
National Data Buoy Center	NOAA Gulf Coast Services Center & National Centers for Coastal Ocean Science
Louisiana Dept. Environmental Quality	Barataria-Terrebonne National Estuary Program
Louisiana Dept. Wildlife and Fisheries	

  - Initiate new activities to fill identified data gaps

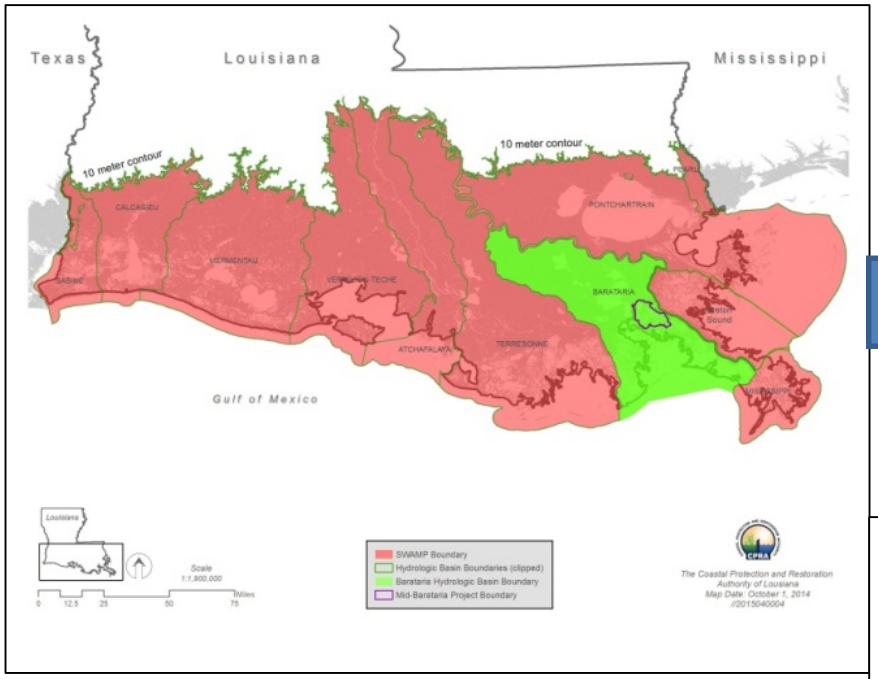
Natural	Human
• Fisheries (LDWF) • Bathymetry (private contractor) • Water Quality (in development) • Above and below ground biomass (in development)	• Dialog among socioeconomic monitoring programs, discuss needs for socioeconomic data, and also look for opportunities to leverage resources among programs • Future development of tools to fill socioeconomic data gaps

  - Coordinate with project teams to coordinate nested project-scale monitoring plans within Barataria Basin
  - Developing/Refining Data Standards, SOPs, QA/QC, Data Management
  - Coordinate with Coastal Information Management System (CIMS) team to add new data types to CPRA's website

SWAMP Timeline

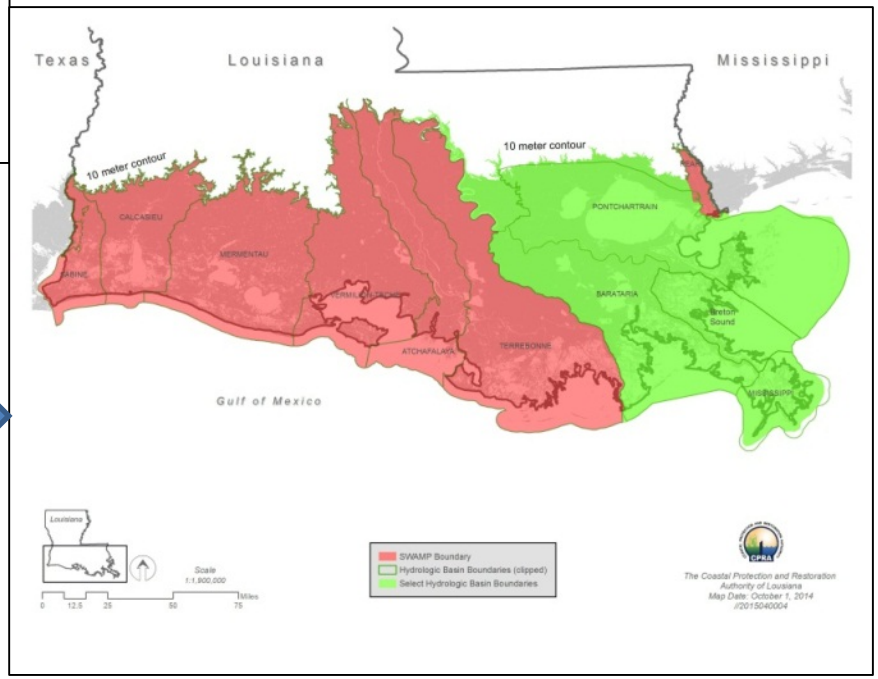


SWAMP Timeline



2015

2016



Questions?

Richard.Raynie@LA.gov

Atmospheric

Protection Data

Restoration Data

Oceanic